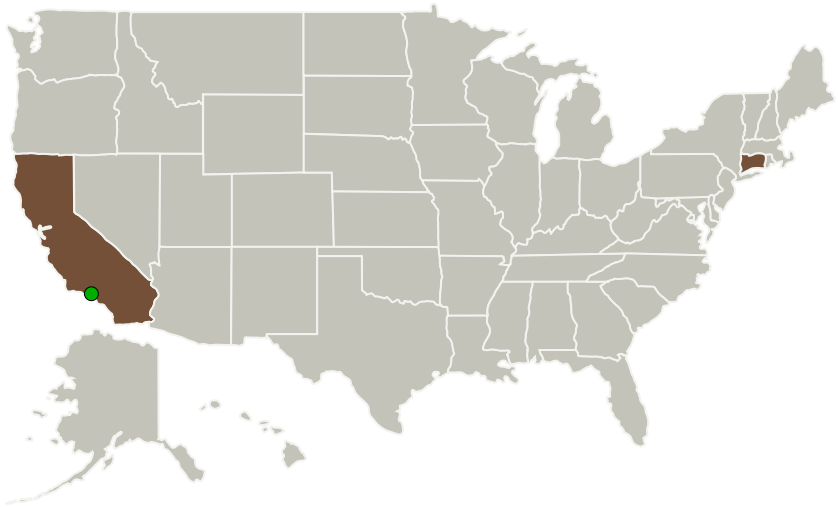
Thermoplastic Forming of Bulk Metallic Glasses for Precision Robotics Components, Phase I

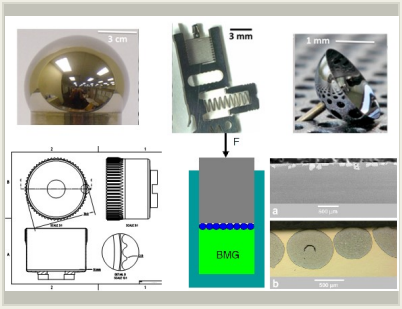
Completed Technology Project (2017 - 2017)

Project Introduction

Demand for novel manufacturing methods for space systems brings unique properties of bulk metallic glasses (BMG) into the spotlight. In addition to superior mechanical properties associated with enhanced reliability, BMG technology can offer new manufacturing processes that result in components with higher precision and complexity, eliminating machining and minimizing final assembly. In this project, we propose to utilize the unique thermoplastic forming (TPF) ability of bulk metallic glasses to net shape high precision robotic gears. The fabrication method that we propose to develop for NASA applications will yield shapes and dimensional accuracies that can't be achieved with any other metal fabrication method and produce thin walled geometries beyond what is possible with machining and casting processes. BMGs have demonstrated superior mechanical properties in extremely low temperature environments and ability to operate without lubricants in gear mechanisms. To take this further, we will explore improvement of friction and wear properties important for gears by fabricating composite surfaces through TPF method using molybdenum disulfide particles. The outcome of the project will be a demonstration of capabilities to manufacture precise robotic components with complex thin walled geometries and improved properties. Beyond space applications, the use of versatile thermoplastic forming processes for precision gears has a strong potential to bring cost savings for a wide range of industries that use robotic mechanisms.

Primary U.S. Work Locations and Key Partners





Thermoplastic forming of bulk metallic glasses for precision robotics components, Phase I Briefing Chart Image

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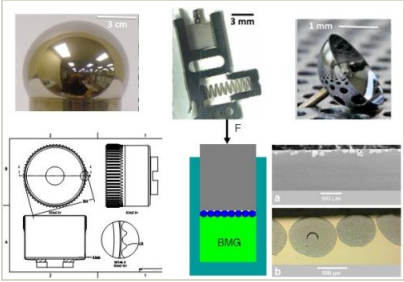
Organizations Performing Work	Role	Type	Location
Supercool Metals, LLC	Lead Organization	Industry Women-Owned Small Business (WOSB)	Branford, Connecticut
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Connecticut

Images



Briefing Chart Image
Thermoplastic forming of bulk metallic glasses for precision robotics components, Phase I Briefing Chart Image *(https://techport.nasa.gov/image/135436)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Supercool Metals, LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

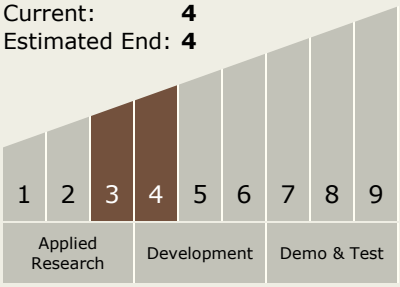
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Evgenia Pekarskaya

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.1 Manufacturing Processes